FORM PTO-1390 (REV 5-93)

U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 225/50111

U S APPLICATION NO. (if known, see 37 CFR 1 5): 09/869134

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/EP99/10234	December 21, 1999	December 23, 1998

TITLE OF INVENTION
BRAKE UNIT

APPLICANT(S) FOR DO/EO/US
Antonio BRAIATO, Andreas PACHNER, Hans-Georg RIEDEL, Detlef SOKOLOWSKY and Björn SPANGEMACHER

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371

3. [x] This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. [x] A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2)).

   a. [ ] is transmitted herewith (required only if not transmitted by the International Bureau).

   b. [x] has been transmitted by the International Bureau

   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US)

6. [X] A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. [ ] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))

   a. [ ] are transmitted herewith (required only if not transmitted by the International Bureau).

   b. [ ] have been transmitted by the International Bureau.

   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.

   d. [ ] have not been made and will not be made.

8. [ ] A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. [X] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). **UNEXECUTED**

10. [x] A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Item 11. to 16. below concern other document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. [x] A FIRST preliminary amendment.

    [ ] A SECOND or SUBSEQUENT preliminary amendment.

14. [X] A substitute specification.

15. [ ] A change of power of attorney and/or address letter.

16. [x] Other items or information:

PCT/IB/308

U.S. APPLICATION NO (if known, see 37 CFR 1 5)	INTERNATIONAL APPLICATION NO	ATTORNEY'S DOCKET NUMBER
09/869134	PCT/EP/10234	225/50111

17. [x] The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Search Report has been prepared by the EPO or JPO ..... $860.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) ... $690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482)		
but international search fee paid to USPTO (37 CFR 1.445(a)(2) ..... $710.00 Neither international preliminary examination fee (37 CFR 1.482) nor		
international search fee (37CFR 1.445(a)(2) paid to USPTO ..... $ 1000.00 International preliminary examination fee paid to USPTO (37 CFR 1.482)		
and all claims satisfied provisions of PCT Article 33(2)-(4) $100.00	$ 860.00	
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than [ ] 20 [x] 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 130.00	

Claims	Number Filed	Number Extra	Rate		
Total Claims	16- 20 =	0	X $18.00	$	
Independent Claims	1 - 3 =	0	X $80.00	$	
Multiple dependent claims(s) (if applicable)			+ $270.00	$	
TOTAL OF ABOVE CALCULATIONS =				$ 990.00	
Applicant claims Small Entity Status (See 37 CFR §1.27) [ ] yes [ ] no. Reduction by 1/2 for filing by small entity, if applicable.				$	
SUBTOTAL =				$ 990.00	
Processing fee of $130.00 for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 990.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). $40.00 per property +				$	
TOTAL FEE ENCLOSED =				$ 990.00	
			Amount to be: refunded	$	
			charged	$	

a. [X] One check in the amount of $990.00 for the filing fee is enclosed
b. [ ] Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.
c. [X] The Commissioner is hereby authorized to charge any additional fees, which may be required, or credit any overpayment to Deposit Account No. 05-1323 . A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:
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for

SIGNATURE
Donald D. Evenson
NAME
26,160
REGISTRATION NUMBER
June 25, 2001
DATE

Attorney Docket: 225/50111
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: ANTONIO BRAIATO ET AL.

Serial No.: NOT YET ASSIGNED Group Art Unit:

PCT APPLICATION NO. PCT/EP99/10234

Filed: JUNE 25, 2001 Examiner:

Title: BRAKING UNIT

PRELIMINARY AMENDMENT

Box NEW APPLICATION
Commissioner for Patents
Washington, D.C. 20231

Sir:

Please enter the following amendments to the specification and claims, as amended by way of Annexes to the International Preliminary Examination Report for PCT/EP99/10234, prior to the examination of the application during the U.S. National Phase.

IN THE CLAIMS:

Please cancel pending Claims 1-16, without prejudice to or disclaimer of the subject matter therein.

Please add new Claims 17-37 as follows:

17. (New) A brake unit, comprising:

at least two brake shoes, each having a friction lining;

at least two pistons per brake shoe;

at least one brake disc rotor with outer surfaces having at least partially a friction surface comprising a metal/ceramic composite material for respective friction linings;

at least two application devices that act upon the at least two brake shoes during braking operation,

wherein each friction lining is associated with an individual application device,

wherein the friction linings cover at least 15% of the friction surface,

wherein the at least two application devices are designed so that pressure acting on the at least two brake shoes acts essentially uniformly on the friction surface during braking operation.

18. (New) A brake unit according to Claim 17, wherein a ratio of a mean height to a mean width of each friction lining is approximately 1:1 to 1:1.6.

19. (New) A brake unit according to Claim 17, comprising a plurality of application devices which act on at least four brake shoes.

20. (New) A brake unit according to Claim 17, wherein single- or multiple-piston callipers, in which one or more brake shoes are arranged, are provided for each application device.

21. (New) A brake unit according to Claim 20, wherein two to six brake shoes are provided for each application device.

22. (New) A brake unit according to Claim 20, wherein four to six brake shoes are provided for each application device.

23. (New) A brake unit according to Claim 17, wherein the at least two application devices comprise mechanical and/or electronic compensation elements, which are designed so that application forces are distributed uniformly to a plurality of friction linings by the principle of balanced levers.

24. (New) A brake unit according to Claim 17, wherein the at least two pistons are arranged so that pressure acting on the at least two brake shoes is uniform.

25. (New) A brake unit according to Claim 17, wherein the at least two pistons are arranged so that pressure acting on the at least two brake shoes is for operating friction coefficients of about 0.40 to 0.45.

26. (New) A brake unit according to Claim 17, wherein two brake shoes per friction surface of the brake disc rotor are arranged so that their lines of action enclose an angle α of about 110 to 130°.

27. (New) A brake unit according to Claim 17, wherein the friction linings have a compressibility of over 1 µm/bar brake fluid pressure.

28. (New) A brake unit according to Claim 17, further comprising an intermediate layer having a compressibility of over 1 µm/bar brake fluid pressure and located between the friction linings of the brake shoes of the application device.

29. (New) A brake unit according to Claim 17, wherein at least the friction surfaces comprise an aluminum/ceramic composite material or a silicon/ceramic composite material.

30. (New) A brake unit according to Claim 17, wherein at least the friction surfaces comprise a fiber-reinforced composite material.

31. (New) A brake unit according to Claim 30, wherein the metal/ceramic composite material contains at least one of carbon fibers or silicon carbide fibers as reinforcing fibers.

32. (New) A brake unit according to Claim 30, wherein the metal/ceramic composite material contains long fibers.

33. (New) A brake unit according to Claim 32, wherein the long fibers are in the form of woven fibre structures or non-woven fibre structures.

34. (New) A brake unit according to Claim 30, wherein the metal/ceramic composite material contains short fibers.

35. (New) A brake unit according to Claim 34, wherein the short fibers are isotropically-oriented short fibers.

36. (New) A brake unit according to Claim 17, wherein the metal/ceramic composite material contains a silicon carbide ceramic or an aluminum oxide ceramic.

37. (New) A brake unit according to Claim 17, wherein the friction surface and the brake disc rotor are formed in one piece and comprise the same material.

IN THE ABSTRACT:

Please substitute the attached Abstract for the original Abstract.

REMARKS

Claims 17-37 are pending herein. By this Preliminary Amendment, Claims 1-16 are canceled, and Claims 17-37 are added.

Because the U.S. Patent and Trademark Office receives the references cited in the International Search Report from the International Bureau, Applicants respectfully request the Examiner to acknowledge the following references on form PTO-892: WO 98 55778; U.S. Patent No. 5,339,931; EP 730 106; U.S. Patent No. 5,477,944; JP 61167723; and Wirth, "Isobar Enhances Disc Brake Performance".

If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #225/50111).

Respectfully submitted,

June 25, 2001

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ABSTRACT OF THE DISCLOSURE

A braking unit has (1) at least two brake shoes, each with a friction lining; (2) at least one brake disk rotor, each of the outer surfaces of the brake disc rotor at least partially forming a friction surface of a ceramic-metal composite material for each friction lining respectively; and (3) at least one brake application device that acts on the brake shoes during braking operation. The friction linings of the brake shoes cover at least 15% of the friction surface of the brake disc rotor. The at least one brake application device is arranged so that the pressure which acts on the brake shoes during the braking operation acts essentially evenly on the friction surface.

225/5011

P030034/WO/1

Original Documents

09/869134

DaimlerChrysler AG
Stuttgart

JC03 Rec'd PCT/PTC 25 JUN 2001

BRAKE UNIT

The present invention relates to a brake unit, which has at least two brake shoes, each with a friction lining, and at least one brake disc rotor, the outer surfaces of the brake disc rotor each having at least partially a friction surface composed of a metal/ceramic composite material (CMC) for respective friction linings, and at least one application device, which acts upon the brake shoes during the braking operation.

Conventional brake units, especially in motor vehicles, generally have brake disc rotors made from a cast-iron material or grey cast iron. However, the trend is towards using brake disc rotors made from a ceramic/metal composite material or for at least the friction surfaces of the brake disc rotor to be composed of a ceramic/metal composite material. Components of this kind are disclosed by DE 44 38 456 A1, for example.

When brake disc rotors of this kind are used in brake units of conventional design, however, the temperatures that occur at the friction surfaces, especially during braking operations that involve a high braking power, are significantly above those at comparable brake disc rotors made of cast iron material and cannot be tolerated by the friction linings of the brake shoes that are normally used. This results in "fading phenomena" and high wear on the brake linings.

It is therefore the object of the invention to provide a brake unit of the abovementioned type in which brake disc rotors with friction surfaces made from a ceramic/metal composite material and customary brake linings are combined in a compatible way.

The solution comprises the friction linings of the brake shoes covering at least 15% of the friction surface of the brake disc rotor, the at least one application device being designed in such a way that the

pressure acting on the brake shoes acts essentially uniformly on the friction surface during the braking operation.

Thus, according to the invention, the disadvantage of the relatively poor thermal tolerance of the friction linings of the brake shoes is compensated for by increasing the surface area of the friction linings that acts on the friction surface of the brake disc rotor, the friction linings simultaneously being pressed against the friction surface of the brake disc rotor as uniformly as possible thanks to homogeneous introduction of the application forces, with the result that there is no local increase in the thermal flux density.

Advantageous developments will become apparent from the subclaims. An advantageous embodiment of the present invention consists in that the ratio of the mean height to the mean width of each friction lining of a brake shoe is approximately 1:1 to 1:1.6.

Another advantageous development envisages that an application device is provided, which acts on at least two brake shoes, at least two pistons being provided per brake shoe. The brake shoes are thus pressed into contact in such a way under the action of two or more, preferably two to four, pistons that uniform pressure is ensured, even under the action of the braking torque. In another embodiment of the present invention an application device is provided, which acts on at least four brake shoes, at least two pistons being provided per brake shoe. These are therefore application devices of comparatively simple configuration with multiple-piston callipers, preferably two-, three- or four-piston callipers. The more pistons are provided for each calliper, the more advantageous it is to provide either compressible friction linings or a compressible intermediate layer between the friction lining and the calliper, in each case preferably with a compressibility of more than 1 µm/bar brake fluid pressure.

Another advantageous refinement of the present invention consists in that a plurality of individual friction linings, each with associated individual application devices, is provided. This can be accomplished by means of single-piston callipers or multiple-piston callipers, in which one or more, preferably two to six, particularly preferably four or six, brake shoes are arranged. The friction surfaces of these brake shoes are advantageously large in the radial direction but comparatively small in the circumferential direction.

The at least one application device can furthermore have mechanical and/or electronic compensation elements, which are designed in such a way that the application forces are distributed uniformly to a plurality of friction linings using the principle of balanced levers. An improvement in the pressure is achieved by this means. An improvement in the pressure between the brake disc rotor and the brake shoes can also be achieved by using friction linings with a compressibility of over 1 µm/bar brake fluid pressure and/or an intermediate layer, provided between the friction linings and the application device, with a compressibility of over 1 µm/bar brake fluid pressure.

Especially when using more than two hydraulically actuated pistons, e.g. eight pistons, in conjunction with four friction linings per application device, it is advantageous if the pistons are arranged in such a way that the pressure acting on the brake shoes is as uniform as possible, in particular for operating friction coefficients of about 0.40 to 0.45.

To suppress braking noise, it is furthermore advantageous to configure the way in which the brake disc rotor is acted upon by the friction linings in such a way that both vibration nodes and vibration antinodes of the critical K0/3 vibration of the brake disc rotor are prevented. This is achieved by virtue of the fact that two brake shoes per friction surface of the brake disc

rotor are arranged in such a way that their lines of action enclose an angle α of about 110 to 130°.

Another advantageous development envisages that at least the friction surface of the brake disc rotor or the entire brake disc rotor or the entire brake disc should be composed of a ceramic/metal composite material, preferably an aluminium/ceramic composite material, e.g. one based on aluminium oxide, titanium dioxide, boron trioxide and/or titanium boride with aluminium, as described, for example, in German patent application 197 06 925.8-45, or a silicon/ceramic composite material, e.g. one based on silicon carbide. A fibre-reinforced composite material that has carbon fibres and/or silicon carbide fibres, for example, as reinforcing fibres is particularly preferred. However, other fibres based on carbon, nitrogen, silicon or boron are also suitable.

Long fibres, preferably in the form of woven fibre structures or nonwoven scrims, are suitable as reinforcing fibres. Short fibres, preferably isotropically oriented short fibres (cf. DE 197 11 829 C1), are particularly preferred, ensuring that the friction surface and/or brake disc has isotropic, i.e. uniform, properties both in the longitudinal and in the transverse direction.

As the ceramic component, the composite material can contain a silicon carbide ceramic or an aluminium oxide ceramic, for example. However, other ceramics are also suitable.

The friction surface of the brake disc rotor and the brake disc rotor are preferably formed in one piece and are composed of the same material, i.e. of a CMC material. It is particularly preferred to produce the entire brake disc in one piece of a CMC material, making manufacture particularly simple and economical.

The present invention is described in greater detail below with reference to the attached drawings, in which:

Figure 1 shows a schematic representation of a

brake unit according to the invention, which is not to scale;

Figure 2 shows a section along the line II - II in Figure 1;

Figure 3 shows an illustration corresponding to Figure 2 of another embodiment of the present invention;

Figure 4 shows a schematic representation of the lines of action of the shoe pressure;

Figure 5 shows a schematic representation of another embodiment of the present invention;

Figure 6 shows a schematic representation of the K0/3 vibration of a brake disc rotor.

Figure 1 shows a brake unit 10 with a brake disc rotor or brake disc 11 composed of a ceramic/metal composite material, the outer surface of which is formed by friction surfaces 12a, 12b. The brake disc 11 is fixed in a manner known per se (not shown specifically) by means of a brake-disc chamber or adapter 13. The brake unit 10 .furthermore has two brake shoes 20a, 20b with friction linings 21a, 21b, which act on the friction surfaces 12a, 12b of the brake disc 11 during the braking operation. An application device 30 known per se and illustrated in a purely schematic way is used to act upon piston pressure faces of brake pistons 31, 32, causing the brake shoes 20a, 20b to act on the friction surfaces 12a, 12b and initiating the braking operation. In this arrangement, the friction linings cover approximately at least 15% of the friction surface, the pressure acting on the brake shoes 20a, 20b being as uniform as possible, i.e. the friction linings are acted upon uniformly over their entire area.

Figure 2 illustrates an embodiment of the size ratio, in accordance with the invention, of the friction linings. The ratio of the mean height (h) to the mean width b, which is decisive in the case of the illustrated trapezoidal shape of the friction lining 21a, is preferably about 1:1 to 1:1.6 in order to ensure that there is a large radial overlap with the friction surface

12a. The friction surface 21a therefore tends to be large radially but comparatively small in the circumferential direction.

Figure 3 shows an embodiment of the present invention in which two friction linings 21a' and 21a'' are arranged at the friction surface 12a. To improve the pressure, two hydraulically actuated pistons 31a', 31b' or 31a'', 31b'' are used per friction lining. In the exemplary embodiment, the pistons are distributed uniformly and arranged in such a way that there is a uniform action over the entire friction surface, especially in the case of an operating friction coefficient of between about 0.40 and 0.45, with the brake disc 11 rotating in the direction of arrow D, ensuring that there are no local increases in thermal flux density. This can also be achieved, for example, by using eight pistons in conjunction with four linings per application device. To avoid non-uniform distribution of power, a plurality of individual friction linings, each with associated individual application devices, is preferably used. This can be accomplished by means of single-piston callipers or multiple-piston callipers, in which one or more, preferably two to six, particularly preferably four or six friction linings, are arranged. These friction linings are preferably each pressed into contact by two to four pistons in such a way that uniform pressure is ensured even under the action of the braking torque. As described, the friction linings of these brake shoes are advantageously large in the radial direction but comparatively small in the circumferential direction.

One factor that is not shown is that the at least one application device can furthermore have mechanical and/or electronic compensation elements, these being designed in such a way that the application forces are distributed uniformly to a plurality of friction linings using the principle of balanced levers. The result is illustrated schematically in Figure 4. The line of action of the ideal pressure with the brake disc 11 rotating in

the direction of arrow D and a given friction coefficient μ is denoted by Wi. The line of action of the piston is denoted by Wk. The energy ε introduced by the action of the piston is controlled in such a way as a function of the friction coefficient μ that the ideal pressure described is achieved. An equilibrium at the individual brake shoe and thus an improvement in the pressure is thereby achieved. An improvement in the pressure between the brake disc rotor and the brake shoes can also be achieved by using friction linings with a compressibility of over 1 µm/bar brake fluid pressure and/or an intermediate layer, provided between the friction linings and the application device, with a compressibility of over 1 µm/bar brake fluid pressure.

The same applies, of course, mutatis mutandis, to friction surface 12b.

To suppress braking noise, two brake shoes 20a', 20a'' per friction surface of the brake disc 11 are arranged in such a way, as shown in Figure 5, that their lines of action enclose an angle α of about 110 to 130°. The result is illustrated in Figure 6. This shows the typical K0/3 vibration of the brake disc rotor as a function of the angle of rotation of the rotor, antinodes of the K0/3 vibration being prevented by virtue of the arrangement of the friction surfaces 21a', 21a''. The same applies, mutatis mutandis, to vibration nodes given appropriate arrangement of the brake shoes.

DaimlerChrysler AG
Stuttgart

New patent claims

1. Brake unit (10), which has at least two brake shoes (20a, 20b), each with a friction lining (21a, 21b), and at least one brake disc rotor (11), the outer surfaces of the brake disc rotor (11) each having at least partially a friction surface (12a, 12b) composed of a metal/ceramic composite material (CMC) for respective friction linings (21a, 21b), and at least one application device (30), which acts upon the brake shoes (20a, 20b) during the braking operation, characterized in that at least two application devices (30) are provided, which act upon at least two brake shoes (20a, 20b), at least two pistons (31, 32) being provided per brake shoe (20a, 20b), in that brake shoes are provided with individual friction linings, each with associated individual application devices, and in that the friction linings (21a, 21b) of the brake shoes (20a, 20b) cover at least 15% of the friction surface (12a, 12b) of the brake disc rotor (11), the at least two application devices (30) being designed in such a way that the pressure acting on the brake shoes (20a, 20b) acts essentially uniformly on the friction surface (12a, 12b) during the braking operation.

2. Brake unit according to Claim 1, characterized in that the ratio of the mean height (h) to the mean width (b) of each friction lining (21a, 21b) of a brake shoe (20a, 20b) is approximately 1:1 to 1:1.6.

3. Brake unit according to one of the preceding claims, characterized in that a plurality of application devices is provided, which act on at least four brake

shoes, at least two pistons (31, 32) being provided per brake shoe.

4. Brake unit according to one of the preceding claims, characterized in that single- or multiple-piston callipers, in which one or more, preferably two to six, particularly preferably four or six brake shoes are arranged, are provided for each application device.

5. Brake unit according to one of the preceding claims, characterized in that the at least two application devices (30) have mechanical and/or electronic compensation elements, which are designed in such a way that the application forces are distributed uniformly to a plurality of friction linings (21a, 21b) using the principle of balanced levers.

6. Brake unit according to one of the preceding claims, characterized in that the at least two pistons (31, 32) are arranged in such a way that the pressure acting on the brake shoes (20a, 20b) is as uniform as possible, in particular for operating friction coefficients of about 0.40 to 0.45.

7. Brake unit according to one of the preceding claims, characterized in that two brake shoes per friction surface (12a, 12b) of the brake disc rotor (11) are arranged in such a way that their lines of action enclose an angle α of about 110 to 130°.

8. Brake unit according to one of the preceding claims, characterized in that the friction linings (21a, 21b) have a compressibility of over 1 µm/bar brake fluid pressure.

9. Brake unit according to one of the preceding claims, characterized in that an intermediate layer, the compressibility of which is over 1 µm/bar brake fluid pressure, is provided between the friction linings (21a, 21b) of the brake shoes (20a, 20b) of the application

device (30).

10. Brake unit according to one of the preceding claims, characterized in that at least the friction surfaces (12a, 12b) of the brake disc rotor (11) are formed by an aluminium/ceramic composite material or a silicon/ceramic composite material.

11. Brake unit according to one of the preceding claims, characterized in that at least the friction surfaces (12a, 12b) of the brake disc rotor (11) are formed by a fibre-reinforced composite material.

12. Brake unit according to Claim 11, characterized in that the composite material contains carbon fibres and/or silicon carbide fibres as reinforcing fibres.

13. Brake unit according to either of Claims 11 and 12, characterized in that the composite material contains long fibres, preferably in the form of woven fibre structures or nonwoven fibre structures, as reinforcing fibres.

14. Brake unit according to either of Claims 11 and 12, characterized in that the composite material contains short fibres, preferably isotropically oriented short fibres, as reinforcing fibres.

15. Brake unit according to one of the preceding claims, characterized in that the composite material contains a silicon carbide ceramic or an aluminium oxide ceramic as the ceramic component.

16. Brake unit according to one of the preceding claims, characterized in that the friction surface (12a, 12b) of the brake disc rotor (11) and the brake disc rotor (11) are formed in one piece and are composed of the same material.

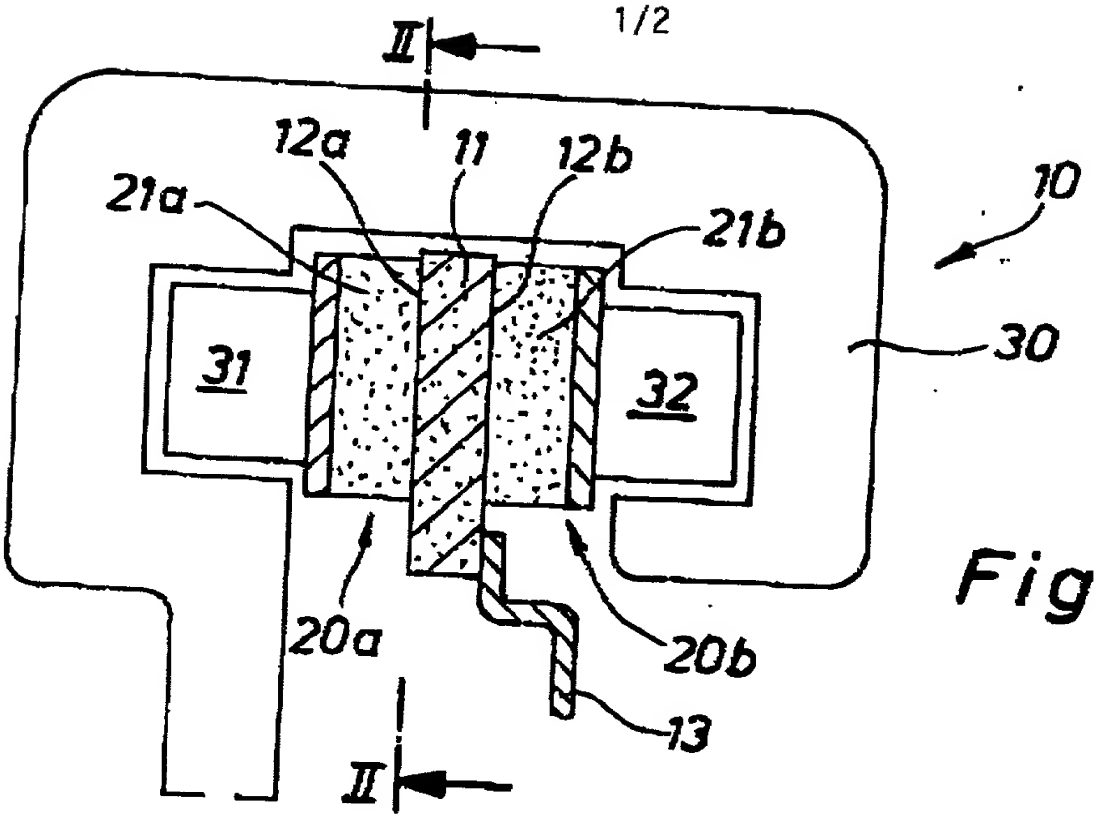

Fig. 1

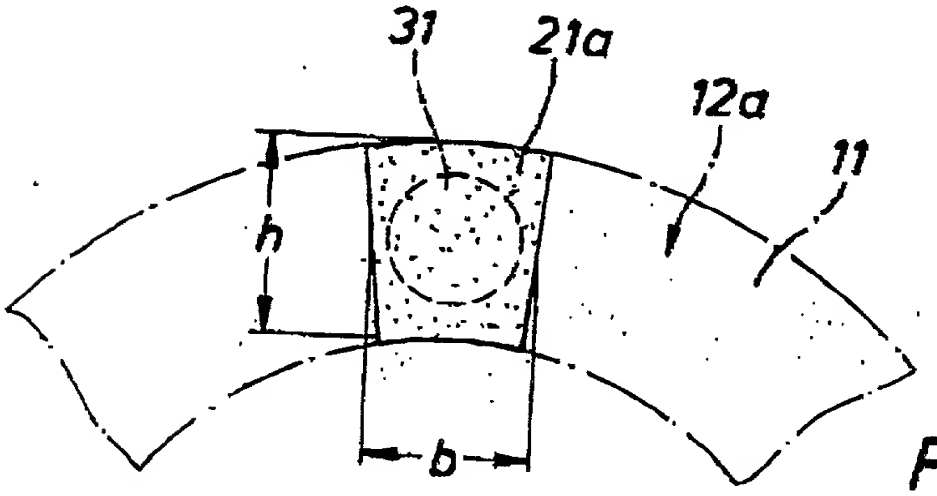

Fig. 2

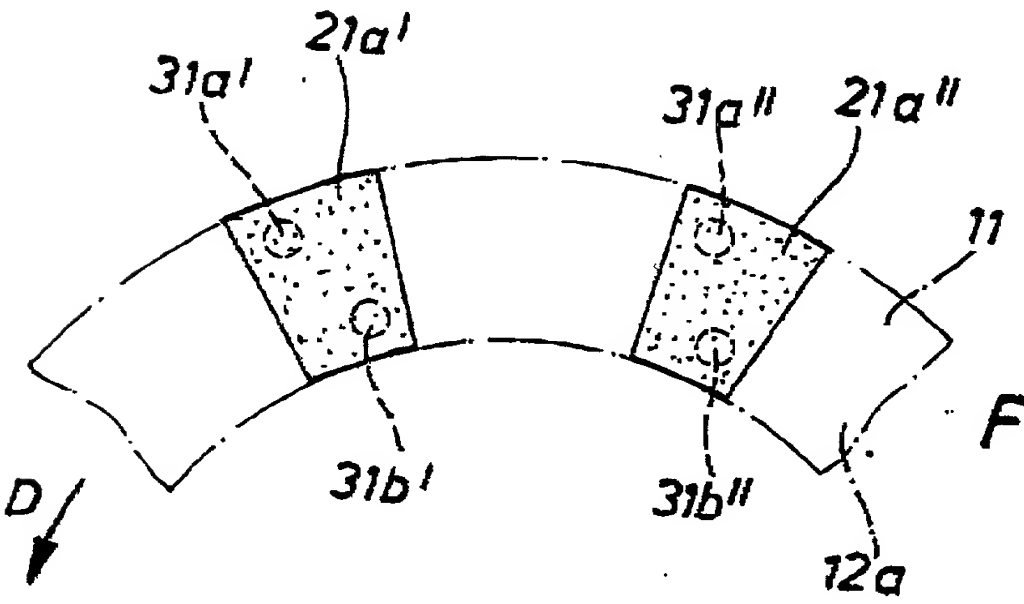

Fig. 3

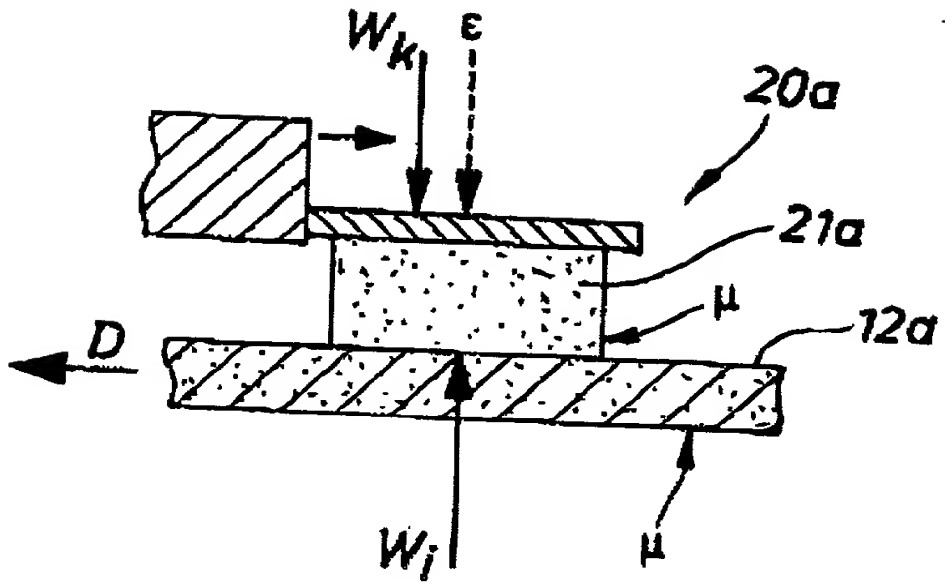

Fig. 4

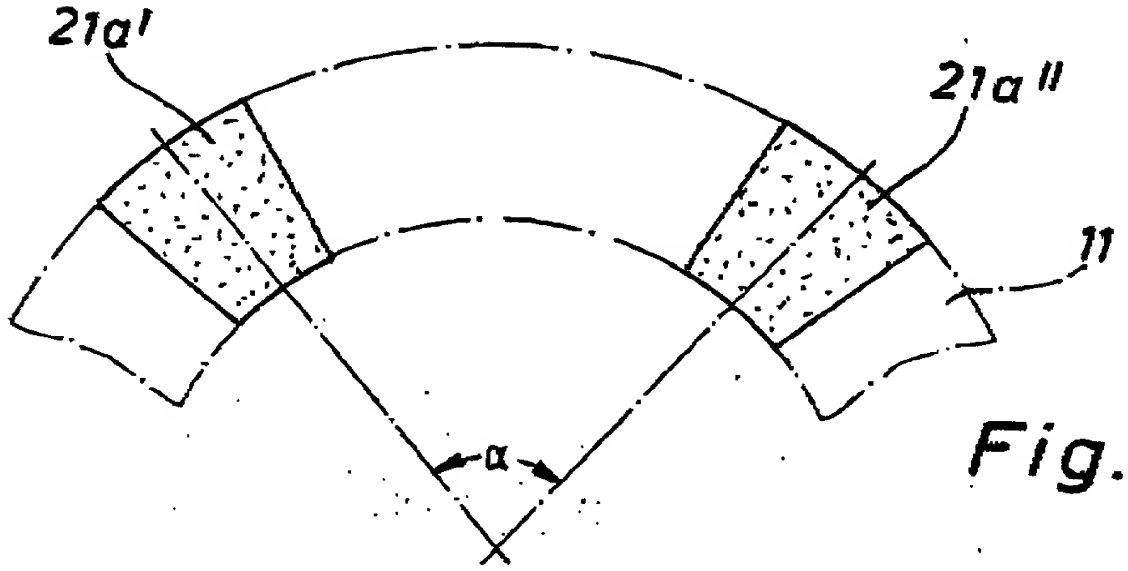

Fig. 5

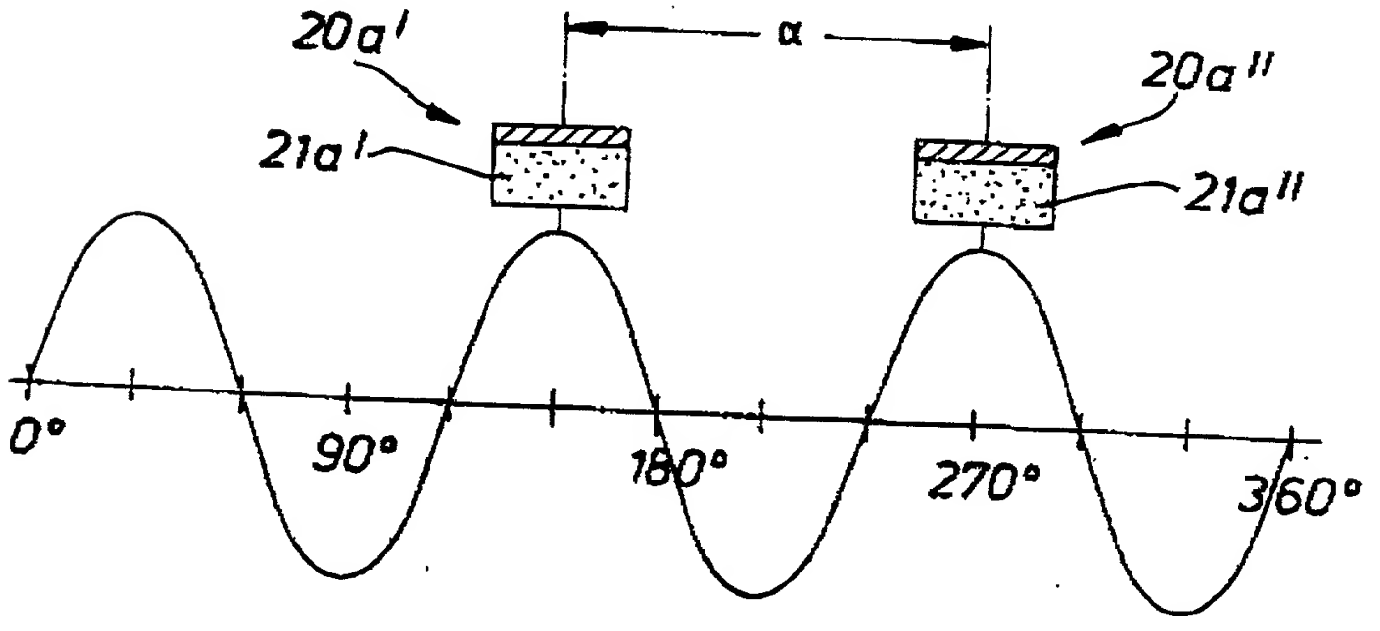

Fig. 6

Attorney Docket No. 225/50111

DECLARATION AND POWER OF ATTORNEY - PATENT APPLICATION

As a below named inventor, I hereby declare that my citizenship, postal address and residence are as stated below; that I verily believe I am the original, first and sole inventor (if only one inventor is named below) or a joint inventor (if plural inventors are named below) of the invention entitled:

BRAKING UNIT

the specification of which

____ is attached hereto, or

_X_ was filed on December 21, 1999 as Application Serial No. PCT/EP99/10234 and was amended on November 28, 2000 (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to be material to patentability as defined in 37 CFR §1.56. I hereby claim foreign priority benefits under Title 35, United States Code §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s)			Priority Claimed
198 59 839.4 (Number)	Germany (Country)	23 December, 1998 (Day/Month/Year)	yes

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose all information known to be material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

(Application Serial No.)	(Filing Date)	(Status)

I hereby appoint as principal attorneys Herbert I. Cantor, Reg. No. 24,392; James F. McKeown, Reg. No. 25,406; Donald D. Evenson, Reg. No. 26,160; Joseph D. Evans, Reg. No. 26,269; Gary R. Edwards, Reg. No. 31,824; and Jeffrey D. Sanok, Reg. No. 32,169, to prosecute and transact all business in the Patent and Trademark Office connected with this application and any related United States and international applications. Please direct all communications to:

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

DECLARATION AND POWER OF ATTORNEY Attorney Docket No. 225/50111

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(date) (signature of 1st inventor)

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01-09-10 _____
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01-10-04 _____
(date) (signature of 4th inventor)

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01-09-19 _____
(date) (signature of 5th inventor)